

CLAIMS

1. A method of partially hydrogenating an unsaturated fat, comprising:
dispersing a nickel-based catalyst in an unsaturated edible oil, the edible oil
having an initial Iodine Value and an initial fatty acid profile;
5 delivering hydrogen to the oil; and
hydrogenating the oil at a hydrogenation temperature no greater than about 75°
C for a hydrogenation time to yield a partially hydrogenated fat having a
modified Iodine Value and including a modified fatty acid profile, wherein the
partially hydrogenated fat has a solid fat content of about 25-80 weight
10 percent at 20° C, an absolute difference between the initial Iodine Value and
the modified Iodine Value (dIV) divided by the hydrogenation time defines an
average Iodine Value change rate of no less than about 5/hour, and no more
than about 15 weight percent of the modified fatty acid profile comprises
trans-fatty acids.
- 15 2. The method of claim 1 wherein the oil is at the hydrogenation temperature when
initiating the hydrogenation and the oil is hydrogenated without adding external
heat.
3. The method of claim 1 wherein hydrogen is delivered to the oil before dispersing
the nickel-based catalyst in the oil.
- 20 4. The method of claim 1 wherein the hydrogenation temperature is no greater than
about 60° C.
5. The method of claim 1 wherein the hydrogenation temperature is no greater than
about 50° C.
6. The method of claim 1 wherein the hydrogenation temperature is about 0-60° C.
- 25 7. The method of claim 1 wherein the hydrogenation temperature is about 20-50°
C.

8. The method of claim 1 wherein the hydrogenation temperature changes over the course of the hydrogenation time, the hydrogenation reaction being initiated at a hydrogenation temperature no greater than about 60° C.
- 5 9. The method of claim 1 wherein the hydrogenation temperature changes over the course of the hydrogenation time, the hydrogenation reaction being initiated at a hydrogenation temperature no greater than about 60° C and the hydrogenation temperature not exceeding about 75° C during the hydrogenation time.
- 10 10. The method of claim 1 wherein the average Iodine Value change rate is between about 6/hour and about 40/hour.
- 11 11. The method of claim 1 wherein delivering hydrogen to the oil comprises delivering a gas consisting essentially of hydrogen.
- 12 12. The method of claim 1 wherein the nickel-based catalyst is substantially the only catalyst source during the hydrogenation of the oil.
- 13 13. The method of claim 1 wherein a total *trans*-fatty acid increase is a difference between the weight percent of the *trans*-fatty acids in the modified fatty acid profile and an initial *trans*-fatty acid weight percent of the initial fatty acid profile, wherein the ratio of dIV to the *trans*-fatty acid increase is at least about 5.
- 14 14. An edible fat composition formed by the process of claim 1.
- 15 15. A method of hydrogenating an edible oil having an initial solid fat content of less than 20 weight percent at 20°C, an initial Iodine Value, and an initial fatty acid profile, the method comprising:
providing a catalyst composition including a fat component and a nickel-based catalyst that has been heated to a first temperature;
dispersing the catalyst composition in the oil;
25 delivering hydrogen to the oil; and

hydrogenating the oil at a second temperature to yield a partially hydrogenated fat having a modified Iodine Value and including a modified fatty acid profile, wherein:

the second temperature is less than the first temperature;

5 the partially hydrogenated fat has a solid fat content of about 20-80 weight percent at 20° C;

an absolute difference between the initial Iodine Value and the modified Iodine Value (dIV) divided by the hydrogenation time defines an average Iodine Value change rate of about 6-40/hour; and

10 no more than about 15 weight percent of the modified fatty acid profile comprises *trans*-fatty acids.

16. The method of claim 15 wherein dispersing the catalyst composition comprises contacting the catalyst composition, which is at a third temperature, with the oil, the third temperature being greater than the second temperature and at least as
15 great as a melting point of the fat composition.

17. An edible fat composition formed by the process of claim 15 or claim 16.

18. A partially hydrogenated fat selected from a group consisting of partially hydrogenated soybean oil and partially hydrogenated rapeseed oil, the partially hydrogenated fat having:
20 a solid fat content of at least about 20 weight percent at 20° C;
a *trans*-fatty acid content of about 4-20 weight percent of the fatty acid profile;
and
a ratio of C18 content to the *trans*-fatty acid content (C18 : TFA) of at least about one.

25 19. The partially hydrogenated fat of claim 18 wherein the *trans*-fatty acid content is no greater than about 10 weight percent.

20. The partially hydrogenated fat of claim 18 wherein the *trans*-fatty acid content is no greater than about 8 weight percent.

21. The partially hydrogenated fat of any one of claims 18-20 wherein the C18 : TFA ratio is at least about two.
22. The partially hydrogenated fat of any one of claims 18-20 wherein the C18 : TFA ratio is at least about 4.
- 5 23. The partially hydrogenated fat of any one of claims 18-22 wherein a ratio of the solid fat content at 20° C to the *trans*-fatty acid content is at least about two.
24. The partially hydrogenated fat of any one of claims 18-22 wherein a ratio of the solid fat content at 20° C to the *trans*-fatty acid content is at least about 4.
- 10 25. The partially hydrogenated fat of any one of claims 18-24 wherein the partially hydrogenated oil had an initial Iodine Value prior to hydrogenation and the partially hydrogenated fat has a final Iodine Value, a ratio of the absolute value of a difference between the initial and final Iodine Values to the *trans*-fatty acid content is at least about 4.
- 15 26. The partially hydrogenated fat of any one of claims 18-25 wherein the solid fat content at 20° C is about 40-80 weight percent.
27. The partially hydrogenated fat of claim 26 wherein a ratio of the solid fat content at 20° C to the *trans*-fatty acid content is at least about 6.
28. The partially hydrogenated fat of claim 26 wherein a ratio of the solid fat content at 30° C to the *trans*-fatty acid content is at least about 3.
- 20 29. The partially hydrogenated fat of claim 26 wherein a ratio of a *cis*-fatty acid content to the *trans*-fatty acid content is at least about 3.
30. A partially hydrogenated fat selected from a group consisting of partially hydrogenated soybean oil and partially hydrogenated rapeseed oil, the partially hydrogenated fat having:
- 25 a solid fat content of about 20-80 weight percent at 20° C;

a *trans*-fatty acid content of no greater than about 15 weight percent of the fatty acid profile; and

a ratio of the solid fat content at 20° C to the *trans*-fatty acid content (SFC 20 : TFA) of at least about two.

- 5 31. The partially hydrogenated fat of claim 30 wherein the *trans*-fatty acid content is no greater than about 10 weight percent.
32. The partially hydrogenated fat of claim 30 wherein the *trans*-fatty acid content is no greater than about 8 weight percent.
33. The partially hydrogenated fat of any one of claims 30-32 wherein the SFC 20 :
10 TFA ratio is at least about 4.
34. The partially hydrogenated fat of any one of claims 30-32 wherein the SFC 20 : TFA ratio is at least about 6.
35. The partially hydrogenated fat of any one of claims 30-34 wherein a ratio of a *cis*-fatty acid content to the *trans*-fatty acid content is at least about 3.
- 15 36. The partially hydrogenated fat of any one of claims 30-35 wherein a ratio of C18 content to the *trans*-fatty acid content is at least about two.
37. The partially hydrogenated fat of any one of claims 30-35 wherein a ratio of C18 content to the *trans*-fatty acid content is at least about 4.
38. The partially hydrogenated fat of any one of claims 30-37 wherein the solid fat
20 content at 20° C is about 40-80 weight percent.
39. The partially hydrogenated fat of claim 38 wherein a ratio of the solid fat content at 30° C to the *trans*-fatty acid content is at least about 3.
40. A partially hydrogenated fat selected from a group consisting of partially hydrogenated soybean oil, partially hydrogenated rapeseed oil, and partially

hydrogenated sunflower oil, the partially hydrogenated fat having a fatty acid profile in which:

a solid fat content is about 40-80 weight percent at 20° C;

a *trans*-fatty acid content is no greater than about 15 weight percent; and

5 a ratio of C18 content to the *trans*-fatty acid content (C18 : TFA) is at least about two.

41. The partially hydrogenated fat of claim 40 wherein the *trans*-fatty acid content is no greater than about 10 weight percent.

10 42. The partially hydrogenated fat of claim 40 wherein the *trans*-fatty acid content is no greater than about 8 weight percent.

43. The partially hydrogenated fat of any one of claims 40-42 wherein the C18 : TFA ratio is at least about 4.

44. The partially hydrogenated fat of any one of claims 40-43 wherein a ratio of the solid fat content at 20° C to the *trans*-fatty acid content is at least about 4.

15 45. The partially hydrogenated fat of any one of claims 40-43 wherein the a ratio of the solid fat content at 20° C to the *trans*-fatty acid content is at least about 6.

46. The partially hydrogenated fat of any one of claims 40-45 wherein a ratio of the solid fat content at 30° C to the *trans*-fatty acid content is at least about 3.

20 47. The partially hydrogenated fat of any one of claims 40-46 wherein a ratio of a *cis*-fatty acid content to the *trans*-fatty acid content is at least about 3.

48. The partially hydrogenated fat of any one of claims 40-47 wherein a ratio of C18 content to the *trans*-fatty acid content is at least about two.

49. The partially hydrogenated fat of any one of claims 40-47 wherein a ratio of C18 content to the *trans*-fatty acid content is at least about 4.

25 50. A partially hydrogenated palm fat having a fatty acid profile in which:

a solid fat content is about 40-80 weight percent at 20° C;
a *trans*-fatty acid content is no greater than about 10 weight percent; and
a ratio of the solid fat content at 20° C to the *trans*-fatty acid content (SFC 20 :
TFA) is at least about 4.

- 5 51. The partially hydrogenated palm fat of claim 50 wherein the *trans*-fatty acid
content is no greater than about 6 weight percent.
52. The partially hydrogenated palm fat of claim 50 or claim 51 wherein the SFC 20 :
TFA ratio is at least about 6.
53. The partially hydrogenated palm fat of claim 50 or claim 51 wherein the SFC 20 :
10 TFA ratio is at least about 8.
54. The partially hydrogenated palm fat of any one of claims 50-53 wherein a ratio of
a *cis*-fatty acid content to the *trans*-fatty acid content is at least about 3.
55. The partially hydrogenated palm fat of any one of claims 50-53 wherein a ratio of
a *cis*-fatty acid content to the *trans*-fatty acid content is at least about 4.
- 15 56. A food product comprising the fat of any one of claims 14, 17, 18, 30, 40, or 50.
57. A frying fat composition comprising the fat of any one of claims 14, 17, 18, 30,
40, or 50.
58. A shortening composition comprising the fat of any one of claims 14, 17, 18, 30,
40, or 50.
- 20 59. The shortening composition of claim 58 wherein the fat has a solid fat content at
20° C of at least about 40 weight percent, further comprising a liquid oil blended
with the fat.
60. A margarine composition comprising water and the fat of any one of claims 14,
17, 18, 30, 40, or 50.